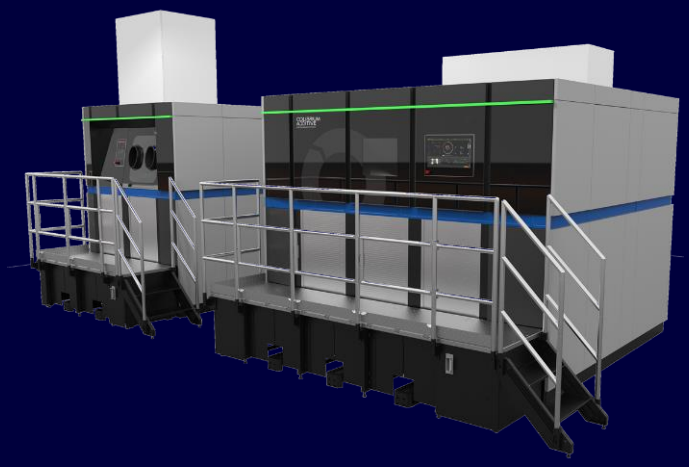
COLIBRIUM ADDITIVE
a GE Aerospace company

13 Al

22 Ti | 24 Cr | 26 Fe | 27 Co | 28 Ni | 29 Cu

L-PBF Cobalt Chrome

Parameter for Colibrium Additive's M Line



Cobalt Chrome

Parts are fabricated from cobalt chrome alloys like ASTM F75 CoCr when excellent resistance to high temperatures, corrosion and wear is critical. It is an appropriate selection where nickel-free components are required, such as in orthopedic and dental applications due to the hardness and bio-compatibility necessary for long-term performance. Cobalt chrome alloys are used in additive manufacturing to print parts that often benefit from hot isostatic pressing (HIP), which combines high temperatures and pressures to induce a complex diffusion process that strengthens grain structures, producing fully dense metal parts.

M Line Cobalt Chrome

The CoCr parameter for the Colibrium Additive M Line using 1kW lasers are developed for productivity. The balanced parameter delivers good surface quality while maintaining a very good density.

M Line Cobalt Chrome

Machine Configuration

M Line

1kW Quad-laser architecture

Nitrogen gas

Powder Chemistry

Cobalt Chrome (CoCrMo) powder chemical composition according to ASTM F75

Particle Size: 5-45 µm

Thermal States

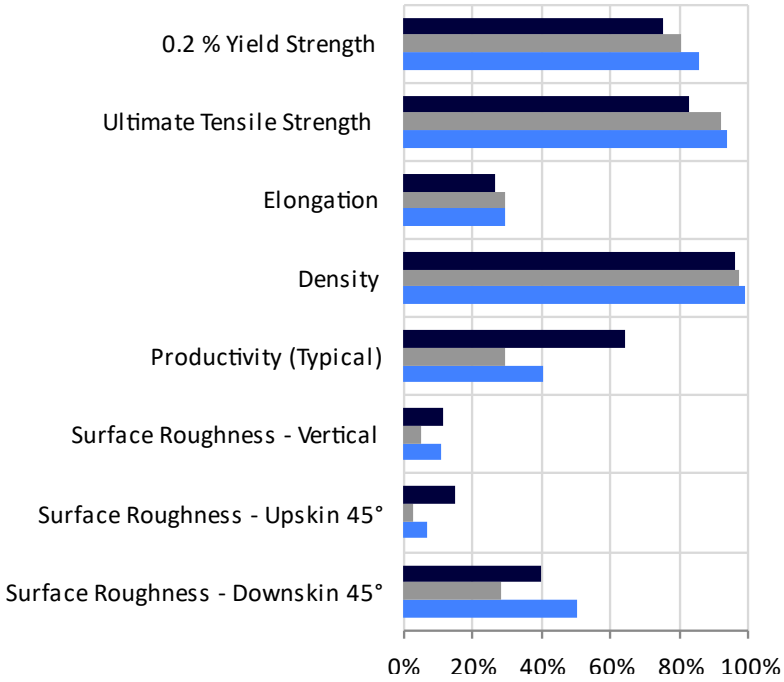
As-Built (AB)

Solution Annealed (SOLN)

SOLN: 1190 °C for 1 hour in argon, water quench

Parameter Availability and Thermal State Comparison

- Balanced Parameter 416 AB
  1 kW, 50 µm layer thickness, rubber recoater
- Balanced Parameter 190 AB
  400 W, 50 µm layer thickness, steel recoater
- Balanced Parameter 320 AB
  400 W, 50 µm layer thickness, steel recoater



Bar Plot is generated by normalizing typical material data (containing both horizontal and vertical data) against a range defined for each material family. For Cobalt alloys, the ranges are as follows: 0.2% YS: 0-1150 MPa, UTS: 0-1450 MPa, Elongation: 0-60 %, Density: 99-100 %, Productivity: 5-60 cm^3/h, Surface Quality (all): 5-40 µm. 0% in the Bar Plot indicates the lower range value, 100% indicates the upper range value.

Balanced Parameter 416 - 1 kW / 50 µm

Typical Build Rate

	(cm^3/h)
Typical build rate with coating[1]	40.2
Theoretical melting rate bulk per laser[2]	53.5

[1] Using standard Factory Acceptance Test layout and 4 lasers

[2] Calculated (layer thickness × scan velocity × hatch distance)

Tensile Performance at Room Temperature

Thermal State	Sample Size	YM (GPa)	0.2% YS (MPa)	UTS (MPa)	Elongation (%)	Area Reduction (%)
As-Built H	12	197	1000	1255	12.0	13
As-Built H – ST	12	189	990	1245	11.5	13
As-Built V	17	116	735	1150	20.0	19
SOLN H	12	220	610	1165	35.0	28
SOLN H – ST	12	227	615	1170	35.5	29
SOLN V	12	224	610	1160	37.5	30

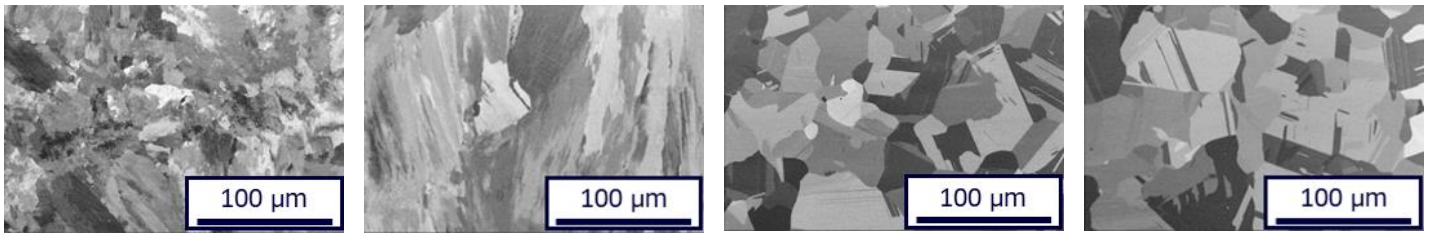
	Overhang Surface Roughness, Ra (µm)		
	45°	60°	75°
Upskin	10	8	6
Downskin	19	10	7

Surface Roughness, Ra (µm)	
H	---
V	9

Thermal State	Relative Density (%)		Hardness (HV10)
	H	V	H
As-Built	99.9	99.9	398
SOLN	---	---	319

Microstructure

As-Built		SOLN	
H	V	H	V



Scanning electron microscope images in As-Built and SOLN condition as defined previously.

Data Sheet Nomenclature and Notation

H: Horizontal, X or Y.
V: Vertical, Z.
Other angles are measured from horizontal.

ST: Stitched, parts built by multiple optical systems

Roughness measurements have been performed according to DIN EN ISO 4287 and DIN EN ISO 4288. In general analysis of the surface quality is strongly dependent on the methodology used and therefore deviations might be observed depending on methodology used. Vertical and horizontal sidewalls have been characterized using a tactile system, overhangs using an optical system.

Tensile evaluations were performed according to ASTM E8 or E21, depending on test temperature.